OP-ED

Pipettes versus Charts: A Comparison of Undergraduate Research Opportunities

Sarah Hin Mui Au-Yeung, B.Sc.(Pharm.) Candidate 2015[1]
[1]*Faculty of Pharmaceutical Sciences, University of British Columbia, Vancouver, BC, Canada*

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To conduct research or work as a pharmacy assistant? That is a dilemma facing some pharmacy undergraduates at some point during their studies. For those interested in research, there are two general types of research they can pursue: basic science or clinical research. With prior experience in basic science research and current training in clinical research, I will shed some light on the types of research students can explore.

Why pursue research experience? What is the attitude towards research among pharmacy students? According to a survey completed by 853 pharmacy students at the University of Sydney in Australia, 76% perceived research to be necessary but 45% found it challenging and were overall ambivalent in pursuing research (1). About 39% of the respondents had exposure to or were involved in research and about 20% intended to pursue a graduate degree in research after completing pharmacy school (1). Interestingly, a trend was noted that as students progressed through the course of the four-year programme, a significantly higher proportion of students had research exposure while a significantly smaller proportion wanted to pursue a graduate research degree (1). The most common reason for the low level of interest was due to a desire to get out into practice and have patient contact rather than spend more time in further studies (1).

However, research is an integral part of practice and cannot be separated. Our profession revolves heavily around understanding disease states and evidence-based medicine stemming from formal reviews of numerous meticulously designed randomized controlled trials. Research keeps our practice cutting edge, innovative, evolutionary, and allows us to give our patients the most up-to-date information about their drug therapies. Our current knowledge comes from years of extensive ongoing basic science and clinical research.

Basic science research

In general, basic science research involves investigations to answer fundamentally important questions that build the foundation for further research (2). Numerous "Bench-to-Bedside" programs exist to encourage basic science researchers to translate their findings into therapeutic interventions and increase our knowledge on disease states (3). For example, the genetic differences that render a patient's cancer cells sensitive or resistant to cisplatin chemotherapy were discovered by principles of cellular and molecular biology (4). This opened up opportunities for further research into targeted therapies aimed to reverse drug resistance (4). Recently, there have been studies that suggest anchoring aspirin to cisplatin may overcome drug resistance, which could lead to improved treatment options in the clinical setting (5).

During the years I spent working at a brain research lab, I observed the challenges and rewards of basic science research. As an Undergraduate Research Assistant, I investigated proteins involved in synapse development and the reported linkage of these proteins to psychiatric disorders such as autism and schizophrenia. This involved carrying out various biochemistry and mice behavioural (i.e. fear conditioning) experiments. One of the major drawbacks of basic science research is that the effort and time spent in carrying out experiments may not translate into data and results. A minor error in execution may result in the experiment failing to yield raw data, which may lead to frustration especially if there is a looming deadline. Most undergraduates who have taken organic chemistry can probably relate to this frustration, particularly during the recrystallization lab where whether the crystals would form properly for evaluation felt like a hit-or-miss! Depending on the experiment, it may have involved expensive equipment and materials or required multiple days to complete. It is not uncommon for researchers and graduate students to put extra hours into their workdays to meet deadlines. Certainly, there were occasions where I had to troubleshoot an experiment when an assay, polymerase chain reaction (PCR), or Western blot did not work.

On the other hand, some researchers find excitement in the unpredictability of basic science research. The possibilities are endless as researchers can choose to investigate their theories from multiple models including cell cultures (*in vitro*), in plants and animals (*in vivo*), and on computers (*in silico*). With

dedication and determination, major breakthrough discoveries, such as developing new antibiotics, can play a role in advancing our healthcare.

Clinical research

Clinical research, referring to epidemiology, public health, or clinical trials, involves research around human subjects aimed to increase knowledge of or to evaluate a treatment for a disease (2). Last year, I conducted chart reviews to evaluate the efficacy of a drug for treating hyperkalemia, and this year, I am conducting oncology chart reviews with a pharmacogenomics research group to characterize adverse drug reactions and to improve drug use. A drawback of clinical research is the wait for data collection, particularly for trials evaluating a treatment over several years but there is the option for retrospective studies. Prior to starting any clinical trials, there are tedious applications to register a clinical trial, such as obtaining ethics approval and patient consent, because human subjects are involved. Of course, there may also be the challenge of deciphering the handwriting in patient charts!

In contrast to basic science, clinical research can be conducted in an office environment with regular hours. Moreover, there is less contact with chemicals, such as paraformaldehyde, for those who are concerned about exposure to suspected carcinogens. Lastly, the results of clinical research can have direct impact on healthcare practice whereas basic science discoveries need to go through multiple phases of clinical trials before implementation is seen.

A randomized controlled trial by the Women's Health Initiative evaluating the risks and benefits of combined estrogen and progestin use in healthy postmenopausal women is an example of clinical research that took years to conduct but changed practice guidelines quickly (6). Originally designed for a duration of 8.5 years, the pivotal trial was stopped after about 5.2 years of follow-up in 2002 when it was found that the health risks, such as invasive breast cancer, exceeded health benefits (6). Currently, hormone replacement therapy is recommended in practice as short-term rather than as long-term symptomatic relief of menopausal symptoms as this carries less risk for the average woman (7).

Give research a try!

Despite differences between the two aforementioned types of research, the fundamentals remain the same. All research contributes information to our expanding knowledge. Research involves a demanding cycle of funding and publishing in prestigious journals, but that does not prevent passionate researchers from seeking answers to their burning questions.

Getting involved in research has benefitted me in many ways as a student. Being able to apply the scientific, lecture-taught concepts into the laboratory helped me better understand the rationale behind lab techniques, which for me trumps pure memorization any day. The same goes for clinical research where I am currently applying my pharmacy knowledge and becoming familiar with common adverse drug reactions. Over the years, I've gained critical thinking skills by learning to analyze raw data and determining the next course of action. Moreover, I picked up time management skills from having to juggle and plan multiple concurrent multistep experiments. Perhaps the most rewarding experience is having the privilege to participate in team meetings and manuscript preparations. Research is one of those activities where you get what you put into it. Due to the endless list of possible benefits, I would highly recommend students take the extra step to become involved in research.

As the number of interested and qualified students is often greater than the number of available positions, landing a research position is not easy. It is important for determined students to take the initiative to contact potential research supervisors. To increase the chances of getting involved with a project, students can consider pursuing positions beyond the pharmacy faculty. Undergraduate research programs, such as the Summer Student Research Program and those provided by the Natural Sciences and Engineering Research Council, encourage Principal Investigators to hire students and engage them in research. Other options include volunteer research or enrolling in research courses offered by universities. However, the financial burden of educational costs may deem volunteering unfeasible for some students when deciding whether to pursue a research opportunity or a paid pharmacy assistant position. Thus, having a stipend from a research program or even through the UBC Work Learn program can make a difference. Nonetheless, I highly recommend pharmacy students to expose themselves to research as being aware of the driving force behind all the healthcare advancements will allow us to appreciate the hard work accomplished by millions of researchers.

References

1) Kritikos VS, Carter S, Moles RJ, Krass I. Undergraduate pharmacy students' perceptions of research in general and attitudes towards pharmacy practice research. International Journal of Pharmacy Practice. 2013 Jun; 21(3):192–201.

2) Primary Ciliary Dyskinesia Foundation. Research and Clinical Trials (Internet). 2011 [cited 7 Jul 2014]. Available from http://www.pcdfoundation.org/about-pcd/research-and-clinical-trials.

3) National Institutes of Health Clinical Center. NIH Bench-to-Bedside Program (Internet). 2014 May [cited 7 Jul 2014]. Available from http://clinicalcenter.nih.gov/ccc/btb/.

4) Li J, Wood WH, Becker KG, Weeraratna AT, Morin PJ. Gene expression response to cisplatin treatment in drug-sensitive and drug-resistant ovarian cancer cells. Oncogene. 2007; 26:2860–2872.

5) Cheng Q, Shi H, Wang H, Min Y, Wang J, Liu Y. The ligation of aspirin to cisplatin demonstrates significant synergistic effects on tumor cells. Chem Commun. 2014; 50:7427–7430.

6) Writing Group for the Women's Health Initiative Investigators. Risks and Benefits of Estrogen Plus Progestin in Healthy Postmenopausal Women: Principal Results From the Women's Health Initiative Randomized Controlled Trial. JAMA. 2002; 288(3):321–333.

7) The Society of Obstetricians and Gynecologists of Canada. Menopause and Osteoporosis Update. JOGC. 2009; 31(1):S19–S26.